NISTIR 6915

# The National Institute of Justice Standards for Hand-Held and Walk-Through Metal Detectors Used in Concealed Weapon and Contraband Detection

Nicholas G. Paulter

NIST
National Institute of Standards and Technology
Technology Administration, U.S. Department of Commerce

NISTIR 6915

# The National Institute of Justice Standards for Hand-Held and Walk-Through Metal Detectors Used in Concealed Weapon and Contraband Detection

Nicholas G. Paulter
*Electricity Division*
*Electronics and Electrical Engineering Laboratory*
*National Institute of Standards and Technology*
*Gaithersburg, MD 20899-8110*

November 2002

**U.S. DEPARTMENT OF COMMERCE**
*Donald L. Evans, Secretary*
**TECHNOLOGY ADMINISTRATION**
*Phillip J. Bond, Under Secretary of Commerce for Technology*
**NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY**
*Arden L. Bement, Jr., Director*

# The National Institute of Justice Standards for Hand-Held and Walk-Through Metal Detectors Used in Concealed Weapon and Contraband Detection

N.G. Paulter[1]
National Institute of Standards and Technology
100 Bureau Drive
Gaithersburg, MD 20899

Abstract: The National Institute of Justice (NIJ) standards for hand-held and walk-through metal detectors were initially published in 1974 and later revised in 2000 and 2002 to accommodate the improvements in metal detector design and component technology and to address the concerns of the criminal justice, law enforcement, and corrections (CJLEC) agencies regarding detection performance, device quality and reliability, and system operation. This paper describes the 2000 and 2002 NIJ standards and how they address the new technology and CJLEC agency concerns. The 1974 standards did not contain requirements for interference, durability, environmental tolerance, and certain detection performance specifications, which were introduced in the 2000 standards. New test objects and detector classifications were also introduced in the 2000 standards. The electromagnetic interference (EMI) requirements given in the 2000 standards were changed in the 2002 standards. The 2002 standards also require the use of slightly different test objects and procedures.

## 1. Introduction

The purpose of this paper is to describe the National Institute of Justice (NIJ, an agency of the U.S. Department of Justice) standards for walk-through and hand-held metal detectors[1,2] with the intention of helping the criminal justice, law enforcement, and corrections (CJLEC) agencies in understanding and applying these standards. The purpose of the standards is to establish performance, quality, and operating requirements and performance test methods for active hand-held and walk-through metal detectors that are used to find metal weapons and/or metal contraband concealed or carried on a person. The hand-held metal detectors can also be used to locate metal weapons and contraband hidden within or on the premises of a building or within a nonmetallic object or body (such as the ground, food, etc.). The walk-through metal detector (WTMD) and hand-held metal detector (HHMD) are used at fixed or portable security checkpoints at correctional facilities, courthouses, events (sporting, dignitary visits, diplomatic audiences), and airports. In addition, HHMDs are sometimes used in lieu of a pat-down search in uncontrolled locations.

---

[1] Electricity Division, Electronics and Electrical Engineering Laboratory, Technology Administration, Department of Commerce. Official contribution of the National Institute of Standards and Technology, not subject to copyright in the U.S.A.

The NIJ standards are technical documents consisting of detection and system performance requirements and, where appropriate, a description of the detection performance test methods. Detection performance requirements include minimum detection sensitivity, allowable speed range of objects passing by/through the detector, interference from other metal objects, detection repeatability, discrimination, etc. System performance requirements, such as environmental tolerance, operator adjustments, and electromagnetic compatibility were added in the 2000 standards because of their impact on the reliability and repeatability of detection.

Performance standards are necessary to ensure that a particular model of a device performs as expected and that each device of that model behaves similarly. A product that does not comply with a standard cannot be expected to perform as required and this affects the users' confidence in that product. Moreover, performance standards assist the user in selecting the product most suitable to their needs from a set of products available from the same or different manufacturers. The standards should be used by CJLEC agencies to ensure the products they are using and buying meet the minimum performance requirements. All tests are to be performed with the manufacturer-supplied detector and sensitivity settings.

The metal detectors covered by the NIJ standards are the ubiquitous metal detectors seen in airports, courthouses, etc. These detectors operate by generating a magnetic field that interacts with nearby objects[3]. It is the interaction of those objects with the generated magnetic field that is the basis of detection. These detectors are frequently called magnetometers, but they are not; magnetometers detect magnetic fields.

## 2. Background

There are presently two NIJ standards for metal detectors, NIJ Standard–0601.02, "Walk-Through Metal Detectors for Use in Concealed Weapon and Contraband Detection," and NIJ Standard–0602.02, "Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection." These NIJ standards were published in 2002 and replace the previous NIJ standards published in 2000, which replaced the NILECJ (presently NIJ) standards[4,5], NILECJ–STD–0601.00 and NILECJ–STD–0602.00, published in 1974. The revisions to the 1974 NILECJ standards, which resulted in the 2000 NIJ standards, were initiated by requests from the law enforcement and corrections community. The revised standards were the results of inputs from CJLEC agencies and detector manufacturers. This document describes the 2002 and 2000 NIJ standards and compares them to each other and to the 1974 NILECJ standards.

The standards have been undergoing continued review since they were published in 2000. Based on this review, revisions have been made to the standards to ensure the standards provide the CJLEC agencies with realistic yet strict performance and system requirements. Both CJLEC agencies and detector manufacturers have been involved in the review processes. The most recent revision, the 2002 revision, was undertaken primarily to improve exemplar design and to reduce the cost of testing without impacting detection performance. To facilitate the review process and provide for on-going comments, the NIJ standards have been made available for viewing on the web at "http://www.eeel.nist.gov/oles/detectors/." Comments on the 2000 NIJ standards are also accepted and displayed for further comment. The user name and password for this web site are "nij" and "nij2001."

The system and detection performance requirements of the standards are described in sections 3.1 through 3.6 of this document and this is followed by a description of the test procedures in sections 4.1, 4.2, and 4.3 and test objects in section 4.4. The system requirements include those for safety (sec. 3.1), electrical power (sec. 3.2), performance (sec. 3.3), operating the device (sec. 3.4.1), functions performed or provided by the detector (sec. 3.6), quality (sec. 3.8), and documentation (sec. 3.9). Lastly, the report sheets of the standards are discussed in section 5. To differentiate between references to sections of this document and sections of the standards, references to the NIJ standards will be prefaced by "NIJ-Std" and italicized.

## 3. Requirements of the Standards

The standards start with a definition section, *NIJ-Std Section 1*, which is provided to facilitate the use and understanding of the standards. *NIJ-Std Section 2* contains all the performance and system requirements and specifications required for acceptance of a detector, either a hand-held or walk-through detector. The performance requirements and specifications of the standards are concerned with detection performance. System requirements and specifications refer to all other requirements and specifications and include power, safety, durability, environmental tolerance, interference, and many others. The 1974 standards did not contain requirements for interference, durability, and environmental tolerance. The 1974 standards also did not contain certain detection performance specifications, as will be described later. The revised 2002 standards replace certain electromagnetic interference (EMI) requirements given in the 2000 standards, add other EMI requirements, and require the use of slightly different test objects. Some of the test procedures in the revised 2002 standards have been modified to reduce the cost of test. However, these modifications do not reduce the ability of the procedures to measure the quality of detection performance. The difference in the standards will be indicated at the end of each section.

### 3.1 Safety Requirements

The first requirements and specifications in the NIJ standards are for safety, which includes electrical, mechanical, and exposure safety. Electrical safety requirements are given to prevent a person from coming in contact with any potentially dangerous voltage source[6]. This is more of a problem for WTMDs, which are typically powered by 110-ac power, than for HHMDs, which are powered by batteries. The mechanical safety requirements state that the detector not have loose coverings, hanging wires, protruding surfaces, sharp edges and corners, etc. that may cause bodily injury. Exposure safety requirements address both biological effects and interference to personal medical electronics devices (PMEDs) caused by the generated magnetic fields. Standards from other agencies or organizations are cited in the NIJ standards to define the magnetic field exposure limits for biological systems (human bodies)[7,8]. However, the powers generated by HHMDs and WTMDs typically used for checkpoint security are well below the exposure limits specified in these other agency documents.

The effect of magnetic fields on PMEDs (cardiac defibrillators, pacemakers, infusion pumps, spinal cord stimulators, ventilators, etc.) has not been studied extensively. To be cautious, however, the NIJ standards cite the Radiation Protection Bureau of Canada exposure limits[9]. Presently, the Center for Device and Radiation Health (CDRH) of the Food and Drug Administration (FDA) is developing methods for measuring the effect of the magnetic fields generated by HHMDs and WTMDs on the operation of PMEDs. The NIJ standards require warnings in the documentation for HHMDs and WTMDs until the FDA or a similar agency has determined that exposure to the magnetic fields generated by HHMDs and WTMDs is not unsafe.

The 1974 standards have requirements for exposure limits and electrical safety, all other safety requirements described above were introduced in the 2000 standard.

### 3.2 Electrical Requirements

The electrical requirements of the standards address the quality and condition of the ac voltage level (for WTMDs) and battery level (for HHMDs). The quality and condition of the power may have an impact on detector performance and, therefore, must be tested. The standards also have a requirement for a visual indicator to alert the operator if a power problem exists.

### 3.3 Detection Performance Specifications

HHMDs and WTMDs are security devices, and if the HHMDs or WTMDs fail to find metal weapons concealed or carried on a person, human safety is unknowingly at risk. Consequently, strict detector performance requirements are critical for public and operator safety. The detection performance specifications of the standards are based on the detection of specific metal test objects. These test objects are also used to define the level of security (see sec. 4.4.1). The term “level of security” is somewhat misleading, as will be discussed in section 4.4.1, and the 2000 standards base detection performance on object size. The test objects are described in section 4.4.2. The performance specifications are listed below along with their descriptions.

Detection Sensitivity - The NIJ standards require that each test object, which is a replica of a threat item, appropriate for the object-size classification of the detector, is detected at specified orientations in the area around the HHMD and in the portal area of the WTMD. The test objects are passed through the portal of the WTMD or by the HHMD for different orientations of the test objects and for different locations within the portal area of the WTMD or different locations by the HHMD.

Speed - Metal detectors must perform properly whether the detector or the person being tested moves quickly or slowly around or through the detector. An average walking speed is about 1 m/s. The speed range for this requirement is 0.2 m/s to 2 m/s. A speed requirement was included in the 1974 standards but revised in the 2000 standards to reduce the lower speed to 0.2 m/s and increase the upper speed to 2 m/s.

Repeatability - The HHMD and WTMD must detect each appropriate test object every time it is presented to the detector. This specification requires that the HHMD and WTMD be tested at its weakest detection location for 50 consecutive trials and detect the appropriate test objects without failure. The repeatability requirement basically defines the probability of detection, $p_d$, for a limited set of trials. For the NIJ standards, the required $p_d$ is 1.0 (or 100 %). This requirement was introduced in the 2000 standards.

Discrimination (WTMD only) - WTMDs are frequently used to detect and alarm on objects that are of a given size or larger, such as a handgun or knife, but not to alarm on objects that are considered innocuous, such as wristwatches, belt buckles, eyeglasses, etc. This specific list of innocuous items was introduced in the 2002 standards along with a more repeatable test than that introduced in the 2000 standards. The discrimination specification requires that the WTMD alarm on the appropriate object but not on an innocuous object. Discrimination was introduced in the 2000 WTMD standard and is only applicable for the larger size threat items. The present requirement for this specification is that the detector must not alarm more than five times out of 25 consecutive trials. The discrimination requirement basically defines the probability of false alarm, $p_{fa}$, for a limited set of trials. For the NIJ standards, the maximum allowable $p_{fa}$ is 0.20 (or 20 %).

Throughput rate (WTMD only) - Throughput rate describes the maximum number of people that can pass through the WTMD and still have the detector correctly alarm on any appropriately-sized hidden metal objects. Throughput rate is an important parameter in correctional facilities and busy courthouses. Throughput rate was required in the 1974 WTMD standard and updated and revised in the 2000 WTMD standard. The requirement for this specification is 50 people per minute.

## 3.4 Operating Requirements

### 3.4.1 Operator Controls

This requirement specifies that only certain controls necessary to operate the HHMD or WTMD be accessible to the operator only. This prevents anyone from tampering with or inadvertently changing the detection parameters of the HHMD or WTMD. The standards also list the operator controls that must be provided. This requirement was in the 1974 standards and updated in the 2000 standards.

### 3.4.2 Interference

There are primarily four types of interferences addressed in the NIJ metal detector standards: electromagnetic, mechanical, body, and multiple metal objects.

Electromagnetic interferences (EMI) - EMI can be conducted and/or radiated. The NIJ standards address both EMI generated by HHMDs and WTMDs and the EMI susceptibility of HHMDs and WTMDs. The standards cited in this section are international standards[10,11] and U.S. military standards[12]. The requirement in the standards is that the detectors shall not generate excessive interference nor be susceptible to normally-encountered interference. EMI susceptibility requirements limit the effect that external influences, such as voltage surges, two-way radio communications, and other electronic devices may have on the performance of HHMDs and WTMDs. EMI requirements were in the 1974 standards, however; they were updated and greatly expanded in the 2000 standards, and further refined in the 2002 standards.

Mechanical - Mechanical interferences refer to the effect of nearby metal structures in buildings on the performance of metal detectors. These structures include stationary objects, such as walls and floors, and moving metal objects, such as doors. The requirement is that the detector must not alarm on metal walls or doors when the detector is adjusted to find the appropriate size test object. The stationary interference requirement is present in all revisions of the standards and the metal door requirement was introduced in the 2000 standards.

Body - Body interference is concerned with the nuisance alarms (also called false positive alarms) caused by the interaction of the human body with the metal detector. The requirement is that the detector must not alarm on the human body when the detector is adjusted to find the appropriate size test object. This requirement was introduced in the 2000 metal detector standards.

Multiple metal objects (WTMD only) - This specification requires that the presence of other metal objects passing through the portal must not affect the detection of a threat item (see sec. 9.4) as it is passing through the portal. This requirement was introduced in the 2000 WTMD standard and revised in the 2002 standard.

### 3.4.3 Environmental Ranges and Conditions

HHMDs and WTMDs typically are used in a variety of environmental conditions and can be used both indoors and outdoors. Typically, however, a WTMD is used indoors or in a sheltered outdoor environment. Consequently, the WTMD environmental requirements are not as severe as those of the HHMD. The standards for HHMDs and WTMDs require testing under various environmental conditions that include temperature, relative humidity, salt mist, and solar radiation. Furthermore, the standards have requirements for environmental protection. Performance requirements are specified for the HHMDs and WTMDs when operated under various environmental conditions to ensure that detector performance will not be compromised during normal use.

The 2002 standards provide options for indoor-only and indoor/outdoor HHMD models and indoor-only, sheltered-outdoor, and outdoor WTMD models. The 2000 standards introduced indoor-only and indoor/outdoor models. The standards cited in the NIJ HHMD and WTMD standards for environmental tolerance are U.S. military standards[13-17]. These environmental requirements were introduced in the 2000 standards and revised in the 2002 standards.

## 3.5 Mechanical Specifications and Requirements

### 3.5.1 Dimensions and Weight

HHMDs and WTMDs have weight requirements to reduce fatigue during long-term use (HHMD) and ease of relocation (WTMD). The Federal Aviation Administration (FAA) of the Department of Transportation published an ergonomic study of the then-available (1995) HHMDs[18]. This document considers the effect of HHMD design and operating procedures on the effectiveness of operators using the HHMDs to find concealed objects. Some HHMDs exhibited an apparent advantage over others for long-term use because of reduced operator fatigue and greater comfort during use. Since ease-of-use and comfort affect operator performance, it is recommended that the FAA study be reviewed. The WTMD standard has minimum dimensional requirements so persons can walk normally through the portal without undue restrictions. The WTMD size requirements were introduced in the 1974 standards and revised in the 2000 standards. All other dimension and size requirements were introduced in the 2000 standards.

### 3.5.2 Durability/Ruggedness

A HHMD is subject to a variety of abuses such as dropping, severe bumping, and liquid spills. Therefore, the HHMD must be durable enough to withstand these abuses and still operate properly. Similarly, a WTMD may be bumped, dropped during shipment or relocation, slid or tipped over. The durability specifications in the NIJ standards require that the HHMDs and WTMDs perform properly after being exposed to normal and expected physical abuse. The standards cited in NIJ HHMD and WTMD standards for durability and ruggedness are international standards[19, 20]. These requirements were introduced in the 2000 standards and updated in the 2002 standards.

## 3.6 Functional Requirements

### 3.6.1 Program Storage (WTMD only)

The WTMD is required to have some means of storing its programmed operating parameters so that the WTMD can still operate normally after a power outage or interruption.

This requirement was introduced in the 2000 standard and revised in the 2002 standard.

### 3.6.2 Audible Alarms

The NIJ standards require that the audible alarms be a two-state alarm (on or off). The standard also sets the minimum sound level volume for audible alarms to ensure that the audible alarm can be heard by the operator. Alarms are required for metal detection and system status conditions. The system status alarms alert the operator in the event of any detector malfunction. Audible alarms for metal detection were required in the 1974 standards and the requirement for alarm indicators for other conditions was introduced in the 2000 standards.

### 3.6.3 Visual Indicators

The NIJ standards set a minimum illumination level for visual indicators to ensure that the visual indicator can be seen by the operator. Visual indicators, with the audible alarm turned off, allow an operator to detect metal objects without necessarily alerting the person being searched of an alarm indication. Visual indicators are also required to assure the operator that the detector is performing properly. Visual indicators for metal object detection were required in the 1974 standards and the requirement for visual indicators for other conditions was introduced in the 2000 standards.

### 3.6.4 Detection Signal Output Connector

The WTMD is required to have a detection signal output connector from which an electrical signal (either analog or digital) that is proportional to the magnitude of the detector response can be obtained. This output signal is used to facilitate testing of the WTMD. This requirement was introduced in both the 2000 WTMD and HHMD standards but removed from the 2002 HHMD standard because of the additional cost and complexity of the circuitry needed to meet this requirement.

### 3.6.5 Interchangeability

Any given model of HHMD or WTMD is required to have interchangeable parts and components to facilitate maintenance. This requirement was introduced in the 2000 standards.

### 3.6.6 Field Servicing

The WTMDs are required to be designed for ease of maintenance and the electronics must be of modular design to provide ease of repair. This requirement was introduced in the 2000 standards.

### 3.7 Detector Mount

The manufacturer is required to provide a holder, upon request, for accurately positioning the detector with respect to the measurement system. The detector mount increases measurement repeatability and comparability. This requirement was introduced in the 2000 standards.

### 3.8 Quality Assurance

Quality in the manufacture and test of HHMDs and WTMDs provides the customer with some confidence that the detector will perform properly and that each unit of a given model will behave similarly. Accordingly, to ensure that each HHMD and WTMD meets or exceeds the requirements of these standards and is highly dependable, the manufacturer must meet ISO 9001 quality assurance standards[21]. These standards provide a model for quality assurance in design, development, production, installation, and servicing and are the same as those standards used for a variety of products such as automobiles, consumer electronics, etc. These requirements were introduced in the 2000 standards. In the 2002 standards, requirements for testing laboratory accreditation and test equipment and process performance was introduced[22-24]. A burn-in test requirement was introduced in the 2000 standards to ensure reliability of the detectors. The burn-in test requires that each detector is capable of reliable performance without early burn-out, a statistical sample of each type of detector is subjected to a long period (160 consecutive hours) of cycle and performance testing

### 3.9 Documentation

A documentation requirement was introduced in the 2000 standards. A list and description of the documentation either required or which must be made available to the customer upon request is given. The documentation includes operating instructions, operator training instructions and videotape or CD ROM, technical specifications, certification of inspection and conformance, certification of test procedures, suggested maintenance schedule, and installation instructions.

## 4. Performance Testing Procedures of the Standards

*NIJ-Std Section 3* describes all the test methods that are unique to measuring the detection performance of hand-held and walk-through metal detectors. All other tests, such as those for environmental and mechanical tolerance, are performed in accordance with one of the standards cited in *NIJ-Std Section 6*.

### 4.1 General Test Conditions

To compare the performance of HHMDs and WTMDs from different manufacturers or of different models from a particular manufacturer, it is important that the test conditions be consistent. Consistent test conditions also enhance reproducibility of the measurement.

Although the NIJ standards require proper operation over a range of conditions, well-defined test conditions ensure that the performance data is reproducible.

The HHMDs and WTMDs must be properly installed, have fresh batteries, and be properly adjusted before any performance tests are done. The equipment required for the tests in the standards is listed, and their performance requirements and specifications described. This information assists the testing laboratory in selecting the appropriate instrumentation for performing the tests.

### 4.2 Laboratory Detection Performance Tests

The group of tests described in the *NIJ-Std Section 3.2* is required to assess detection performance. Tests to determine compliance with the other requirements stated in the NIJ standards are referenced to other standards, which are listed in alphabetical order in *NIJ-Std Section 6*. The data format is specified (see sec. 5) to provide uniformity in the data presented to the CJLEC agencies.

### 4.3 Field Testing Procedures

These are test procedures to be performed by the CJLEC officer or agent to make sure the HHMDs and WTMDs are performing properly both when the detector is received from the manufacturer and in the field. To ensure proper operation in the field, the field tests are performed periodically.

### 4.4 Test Objects

The purpose of the test objects is to provide standardized and reproducible objects for conducting detector performance tests. These test objects must be well defined because, in conjunction with the performance test methods, they are the basis upon which all WTMDs and HHMDs produced by manufacturers will be tested for compliance to the NIJ standards and objectively compared. The CJLEC agency can then select the best HHMD or WTMD based on accurate comparative data rather than speculative data.

The test objects used for the NIJ standards are replicas of threat items. Replicas are used because they are safer, in most cases, than the threat item but, moreover, because the dimensional tolerance and material properties of the replicas can be specified to ensure reproducible manufacture. Furthermore, to enhance safety and allow for orientation-dependent performance measurements, the replicas are encased in plastic.

#### 4.4.1 Object Size Classification

Object size class was introduced in the 2000 standards instead of using the familiar security class specified in the 1974 standards. The reason for this change is that it is typically thought that the smaller the threat object that can be found the higher the security. This is not necessarily true. For example, presidential security is one of the highest levels of security yet it is acceptable for someone to approach the president carrying a pen knife in their pocket. On the other hand, possession of any small metal object by an inmate is forbidden. There are three object size classes defined in the 2000 NIJ HHMD and WTMD standards and four object size classes in the 2002 revision (see sec. 4.4.2). The HHMDs and WTMDs may be designed and adjusted to find objects of more than one object size class, in which case the detector must be tested for each object size class.

### 4.4.2 Object Sizes

In the 2002 standards, there are four object size classes, large, medium, small, and very small. The large object size class contains three handguns replicas, one each of three different metals. The medium object size class contains two knife replicas, one each of two different metals. The small object size class includes replicas of a handcuff key, a #2 Phillips screwdriver bit, and a 22 caliber long rifle round. The very small size object class is applicable only for HHMDs and includes a short section of a pen refill and the blade from a disposable razor. The very small object size class is not used for WTMDs because these objects are so small that if the sensitivity of the WTMD was adjusted so that these objects could be found, the WTMD would be constantly alarming because of various interferences. In addition, for the HHMDs, there is an optional small size test object, the hypodermic needle from a disposable syringe. The hypodermic needle is very difficult to find and, therefore, represents the ultimate goal in HHMD metal detection capability.

Not all threat items have a replica that is used as a test object. This is because there are many threat items and the cost of testing HHMDs and WTMDs with all possible test objects would be great. Consequently, the group of threat items for each object size class was examined and those objects that give the smallest detection signal (and, accordingly, would be the hardest to find) and are of different metal types were selected as the test objects.

### 4.4.3 Innocuous Item Test Objects (Large-Sized and Medium-Sized Objects)

The purpose of the innocuous item test objects is to demonstrate discrimination. For example, if the CJLEC agency is maintaining security at a courthouse, large knives and handguns are forbidden but other metal objects, such as watches and pens, are not forbidden. Discrimination allows the operator of the WTMD to find the target items (handguns and knives) and not the innocuous items. Without discrimination in this situation, the operator may have to address everyone entering a courthouse that carried any metal object on their person, and this would cause excessive delays.

In the 2002 WTMD standard, the innocuous items are defined as belt buckles, eyeglasses, shoe shanks, and watches. Innocuous items were removed in the 2002 HHMD standard because it is more often advantageous than not if smaller objects than the object size classification of the detector can be found.

5. References in the Standards

The NIJ standards include a number of references to other agency or organization standards. These standards contain performance requirements and test methods that have been developed by other qualified scientific organizations. By citing these other standards in the NIJ standards, the NIJ standards do not have to duplicate these other efforts.

Summary

The National Institute of Justice (NIJ) standards for hand-held and walk-through metal detectors were described. The initial standards were published in 1974 and revised in 2000 and 2002 to accommodate the improvements in metal detector design and component technology and to address the concerns of the criminal justice, law enforcement, and corrections (CJLEC) agencies regarding detection performance, device quality and reliability, and system operation. The differences in these revisions, published in 1974, 2000, and 2002 were indicated and compared.

References


1. *Walk-Through Metal Detectors for Use in Concealed Weapon and Contraband Detection*, NIJ Standard–0601.01, NCJ 183471, prepared by Nicholas G. Paulter, Jr., National Institute of Standards and Technology, Gaithersburg, MD for the Office of Science and Technology, U.S. Department of Justice, Washington, DC 20531, September 2000.
2. *Hand-Held Metal Detectors for Use in Concealed Weapon and Contraband Detection*, NIJ Standard–0602.01, NCJ 183470, prepared by Nicholas G. Paulter, Jr., National Institute of Standards and Technology, Gaithersburg, MD for the Office of Science and Technology, U.S. Department of Justice, Washington, DC 20531, September 2000.
3. N.G. Paulter, *Users' Guide for Hand-Held and Walk-Through Metal Detectors*, NIJ Guide 600–00, NCJ 184433, Office of Science and Technology, U.S. Department of Justice, Washington, DC 20531, January 2001.
4. *Walk-Through Metal Detectors for Use in Weapons Detection*, NILECJ–STD–0601.00, National Institute of Law Enforcement and Criminal Justice, U.S. Government Printing Office, Washington, DC, 1974.
5. *Hand-Held Metal Detectors for Use in Weapons Detection*, NILECJ–STD–0602.00, National Institute of Law Enforcement and Criminal Justice, U.S. Government Printing Office, Washington, DC, 1974.
6. UL 1950, Second Edition, Underwriters Laboratories, *Standard for Information Technology Equipment, Including Electrical Business Equipment*.

7. IEEE C95.1–1991, Institute of Electrical and Electronic Engineers, *Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.
8. ACGIH–0302 (1996), American Conference of Governmental Industrial Hygienists, *Documentation of the Threshold Limit Values, Sub-Radio Frequency (30 kHz and below) Magnetic Fields*.
9. *Safety Code, Recommended Safety Procedures for the Selection, Installation and Use of Active Metal Detectors*, Radiation Protection Bureau, Canadian Minister of National Health and Welfare.
10. EN 50081–1 1992, European Standard, *Electromagnetic Compatibility - Generic Emission Standard, Part 1: Residential, Commercial, and Light Industry*.
11. EN 50082–1 1998, European Standard, *Electromagnetic Compatibility - Generic Immunity Standard, Part 1: Residential, Commercial, and Light Industry*.
12. MIL–STD–461E Method RS101, Military Standard, *Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment, Method RS101, Radiated Susceptibility, Magnetic Field, 30 Hz to 100 kHz*.
13. MIL–STD–810F Method 501.4, Military Standard, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Method 501.4, High Temperature*.
14. MIL–STD–810F Method 502.4, Military Standard, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Method 502.4, Low Temperature*.
15. MIL–STD–810F Method 505.4, Military Standard, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Method 505.3, Solar Radiation (Sunshine)*.
16. MIL–STD–810F Method 507.4, Military Standard, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Method 507.3, Humidity, Procedure 1 - Natural*.
17. MIL–STD–810F Method 509.4, Military Standard, *Test Method Standard for Environmental Engineering Considerations and Laboratory Tests, Method 509.3, Salt Fog*.
18. J.L. Forbes, D.M. McAnulty, and B.A. Klock, *Screening With Hand-Held Metal Detectors*, DOT/FAA/CT–95/49, Federal Aviation Administration, U.S. Department of Transportation, August, 1995.
19. IEC 68–2–27 1987, International Electrotechnical Commission, *Basic Environmental Testing Procedures, Part 2: Tests - Test Ea and Guidance: Shock*.
20. IEC 68–2–29 1987, International Electrotechnical Commission, *Basic Environmental Testing Procedures, Part 2: Tests - Test Eb and Guidance: Bump*.
21. ISO 9001:2000, International Organization for Standardization 9001, *Quality systems - Model for Quality Assurance in Design, Development, Production, Installation and Servicing*.

22. ISO 10012–1:1993–01–15, International Standards Organization, *Quality Assurance Requirements for Measuring Equipment, Part 1: Metrological Confirmation System for Measuring Equipment*.
23. ISO 10012–2:1997–09–15, International Standards Organization, *Quality Assurance for Measuring Equipment, Part 2: Guidelines for Control Measurement Process*.
24. ISO 17025:1999–12–15, International Standards Organization, *General Requirements for the Competence of Testing and Calibration Laboratories*.